The water volume storage max's out at approximately 80 units totals ~0.4 maft. At that storage volume, then compared to the total water inflow into Lake Okeechobee over the past 4 decades of about 2.1 maf/yr. this temporary storage is about 20% annual reduction inflow into the lake. This assumes 100% operation of the wells with any Murphy law glitches [ie, this storage vol. is maximum]. How does that temporary storage volume compare to Lake Okeechobee's water storage ability say from 15.5 to 16.5 ft NGVD? The completion of the USACE vertical clay/cement hardening of the HHD should permit such an increase without increasing dike breakage beyond an engineering acceptable level. By my calculations, hysographic analysis adds 0.45 maft storage almost equivalent to ASR well construction, utilization and maintenance. Hence what are the cost benefits , the ecological benefits and the long-term water use benefits of ASR wells. As you are well aware, the stored volume must eventually be returned back to the lake. ASR's are temporary storage tanks

Thank you for your comment. A quantitative evaluation of ASR storage volume effects on Lake Okeechobee lake levels currently is under consideration within the Lake Okeechobee System Operating Manual project. This project is ongoing, but does incorporate ASR storage volumes as one of the variables under consideration.

What % of water quality improvements to lake Okeechobee are expected to result from ASR wells? Assuming the TP level of ASR storage/ recovery and treatment results in decreasing the TP from incoming ~ 150 ppb TP to 50 ppb TP and the temporary volume inflow is ~ 20%, then the % reduction to the total annual inflow of ~ 450 mt/yr. is reduced to ~ 415 mt/yr. Is this 35 mt TP reduction cost effective compared to the sum total of TP reduction in CERP and Governor mandated projects worth it? Does this reduction decrease the TP in the water column of the lake? Will the ASR project produce any known reduction in future annual HAB's in the lake?

JEM response: The ASR science plan, and USGS research efforts to date are confirming the mechanisms of phosphorus concentration reductions during ASR system operations. Quantifying the mass of phosphorus reduction during ASR cycle tests, versus other phosphorus inputs to Lake Okeechobee (including suspension of legacy phosphorus in lake sediments) will be pending results obtained during proposed ASR system operations.

Phosphorus [P] and Arsenic [As] are chemical "cousins". They occur together in the periodic chart and in nature. Natural P deposits in Mullbury and Bartow pebbles range from 28-31 ppm As in TP concentrations ~ 30% wt/wt. The recovery of ASR stored water contains both As levels and possibly other non-specified chemicals added naturally or artificially in the storage and recovery process. Initial experiments on this recovered waters showed negative effects on the major zooplanktonic species of Lake Okeechobee, Daphina sp. This zooplankter is the major basis for the third trophic tier for small fish. The USACE has indicated that the As problem in the recovered water has been solved. As a limnologist, I would like to know more on the solution and its reliability with continued ASR well usage.

Geogenic phosphorus in phosphate ore (pebbles) is insoluble in contact with groundwater, so phosphorus will not be mobilized from sedimentary materials during ASR cycle testing. Arsenic is mobilized at some ASR systems due to sedimentary pyrite oxidation by dissolved oxygen. However, arsenic concentrations in recovered water were typically below the drinking water standard (10 ug/L) at the Kissimmee River ASR system during four years of operation. A few of the 7-day static renewal chronic toxicity test results using Ceriodaphnia duba showed an effect on reproduction in recovered water after 75 to 99 percent volume recovered. This reproduction effect could not be attributed to a specific water quality constituent. It was speculated because reduced

reproduction was observed near the end of recovery, it may be related to a constituent in native groundwater.